GamiCSM: Relating education, culture and gamification - a link between worlds

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ABSTRACT

The potential of *gamification* to improve users' *motivation* and *engagement* influenced many researchers and professionals to analyse its effects in educational settings. While some studies focus on adapting game elements according to demographic and behavioural information of the user profile, few of them explore (or even consider) *cultural factors*. These cultural factors play an essential role in our societies' development. Thus, this work proposes and evaluates a representative model to understand better the relationship between cultural factors and gamification within educational domains, namely the *Gamification for Cultural Studies Model (GamiCSM)*. Through a qualitative approach, we map Hofstede's cultural dimensions (i.e., power distance, individualism/collectivism, uncertainty avoidance, masculinity/femininity, long/short-term orientation, and indulgence/restraint) with a Taxonomy of Gamification Elements for Education (TGEEE), a recent model for gamification elements for educational environments. Furthermore, we adapted a survey to evaluate the resultant model with eight domain experts in gamification and education. Based on this evaluation, we are able to propose a starting model, containing some additional refinements and improvements. Thus, the main contributions of this work are: (i) the *first model to relate game elements and cultural dimensions within educational domains* and (ii) a state-of-the-art empirical study intersecting culture, gamification and education.

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CCS CONCEPTS

• **Applied computing** → **Education**; • **Social and professional topics** → *Cultural characteristics.*

KEYWORDS

culture, gamification, model, evaluation

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1 INTRODUCTION

Culture, within the scope of this research, is seen as a structure that ties a group of people. This structure is composed of schemes (patterns) that influence and differentiate the individuals composing the group, allowing these individuals to interact with the environment [20, 42]. A culture can be composed of sub-cultures. For instance, the National Culture is a set of explicit or implicit schemes existent in a country (e.g., in China, people tend to believe that hierarchy should be respected; while in Sweden, people do not think hierarchy should be respected rigidly [21]). Culture plays a major role in education, especially in e-learning systems, since these patterns might influence the way students perceives and acquires their knowledge [42].

Unsurprisingly, then, game-based approaches are also influenced by culture. Even the scheme of "gaming" itself can be considered a subset of a National Culture [28, 44]. Games influence and are influenced by contemporary society behaviours, since they have permeated society, often forming a part of an individuals' routine [4, 11]. An example of how culture has influenced games is the

distinction between sub-genres of role-playing games created in oriental countries, from the ones created in the Occident [3].

These influences also extend to *gamification*, defined as the use of game-like elements outside of a game [6, 27, 43]. Culture is a part of the *context*, which has been shown to be important when designing gamification, to achieve a positive outcome related to motivation or engagement [43]. Context, according to Savard and Mizoguchi [41], can be defined as a set of conditions that encompass an event. This event is held by agents and environments whose interactions enable the given event to occur. An educational context, for example, is composed of a single or group of people (agents) in an environment (or environments) that lead to an event related to learning. This context influences culture as well [41].

In gamification, although there is an increasing awareness about the importance of cultural factors (for instance, the acceptance of certain elements may differ, based on the culture of the users of the system), their exploration represents a current research gap [26]. Recently, Khaleed stated that gamification elements must be aligned with the cultural background of the user, to achieve an optimal effect (e.g., increase performance) [24]. Furthermore, AlMarshedi et al. [2] discuss the importance of cultural aspects in gamification, stating that schemes presented in cultural backgrounds are needed, to understand gamification designs that might influence the users' experience; this is also corroborated by Wellington [52]. In addition, AlMarshedi et al. [2] calls for theoretical work to relate these elements to guide further studies.

Notably in our context, gamification is nowadays considered as increasingly important for educational purposes. Indeed, some studies reported positive effects (e.g., increased motivation and engagement) tied to the use of game elements in educational environments [7]. Nevertheless, other studies present inconclusive results (neither positive nor negative); current thought is that this could be attributed to inappropriate design [51]. Ideally, good designs are those considered to encompass different aspects, such as behavioural profiles and culture of the individual, as well as adaptation to the user needs and characteristics [24, 26, 52].

Adaptation is the process of adapting existing elements to a specific user characteristic, an essential and potentially decisive factor in the effectiveness and adoption of modern e-learning systems [14, 18]. Interestingly, when tied to games and gamification concepts, adaptation has been shown further to increase positive effects on users' motivation [29]. However, past adaptation studies and applications often miss essential aspects that permeate the users' environment, such as culture [26]. This is even more so the case when analysing gamification in adaptive systems, where culture is mostly neglected in the environment design [2, 26, 34].

Thus, this work aims to explore the following research problem: *How can we systematically relate gamification elements and cultural aspects, to use within educational environments?*

To conduct our study, we designed a mixed approach (qualitative research and survey) to create a model that relates gamification elements and cultural dimensions ([21]) for e-learning environments. This work contributes to the fields of:

- Human-Computer Interaction: by providing a first model to adapt culture in gamified learning systems.
- Education: by providing a base model to instructors and educators on the appropriate gamification elements to be used within their culture.
- Gamification: by providing the first empirical model relating culture dimensions and gamification elements for educational environments.

2 BACKGROUND AND RELATED WORKS

This section describes the concepts used in this work, alongside our related works. We explore definitions of culture and describe the model used by Hofstede. As for gamification, we present how these game elements are used within adaptive educational environments and describe a recent taxonomy for gamified educational environments, which is our design starting point. Finally, we present related work to culture and gamification in educational environments.

2.1 Cultural Dimensions

Culture has many definitions. Some authors state that culture is often used to refer to a set of characteristics that are used to differentiate a social group, in a distinct way [1]. Hall [17] described culture as an aggregation of lifestyles, which encompass people behaviour, attitudes and material things. Hofstede [21] defined culture as a set of patterns that differentiate a group of people, but also perceive each member in that group, individually. According to Hofstede [21], the National Culture is a way to distinguish countries based on cultural dimensions. Finally, for education, Savard and Mizoguchi [42] found a relationship between culture and context, where culture is considered a set of schemes that permeate a group of individuals and influence their actions.

Hofstede's model for national culture can be used to compare different cultures and has been thus used heavily both in academia and in industry [40]. This model is composed of six dimensions (Table 1) that can influence students' behaviour and performance, when using e-learning systems, or serious games [9, 21, 47].

As can be seen in Table 1, each dimension shows different aspects of a National Culture. In our context, it is important to include how these dimensions impact upon education, as summarised by Gasparini et al. [14]. For example, in societies with a low PDI degree, education is centred on students, rather than around teachers. Teachers expect students to be pro-active and question or debate everything assertively, in such cultures. While in societies with a higher degree of PDI, education is centred on teachers, and students should respect their authority, above all things in the environment.

2.2 Gamification

Due to its influence on users' motivation, gamification (as the use of game elements outside of games [6]) has been widely used in educational environments [7, 53]. However, to achieve such positive effects, gamification needs to follow good design practices, focusing on a broad range of characteristics of users and their context [27, 39, 49]. As stated by Seaborn and Fels [43], gamification is context-dependent, which means it is essential to understand the environment and its users before implementing it. Whilst gamification aims to promote motivation and engagement in educational settings [7], understanding students (e.g., demographics, behavioural profiles, gaming profiles) is necessary to avoid adverse outcomes

Table 1: Hofstede's Cultural Dimensions for National Culture [21]

Abbr	Dimension	Definition
PDI	Power Distance	Relates to the acceptance of power distribution, e.g., hierarchically in a society. Countries with a higher index of PDI demonstrate that hierarchy is clearly perceived and respected; while a lower degree represents countries where the population questions the authorities, focusing on the equal distribution of power.
MAS	Masculinity × Femininity	Concerns the degree in which societies accept the traditional/conservative model of gender roles, e.g., men in position of power and women in home activities. Countries with a high MAS index are very conservative towards gender roles. Lower degrees of MAS mean that countries are more positive or leaning towards equal rights regarding gender roles.
IDV	Individualism × Collectivism	Considers the degree in which societies are integrated into groups. In countries with a high degree of IDV, individuals tend to be less empathetic and consider themselves first, in their decision-making process and actions. In countries with a low degree of IDV, people tend to think more about the collective instead of themselves (e.g., Japan).
UAI	Uncertainty Avoidance Index	Concerns the degree to which people deal with ambiguity. In countries with a high degree of UAI, people tend to accept only a single "truth", with no space for discussion; while a lower degree means a society that leans more towards discussing different ideas and perspectives.
LTO	Long-term Orientation × Short-term Orientation	Relates to the degree in which societies associate past choices with present / future actions. High degrees of LTO means that a country tends to follow its traditions (more conservative), lower degrees means that a country's decision-making process is either adapted or based on circumstances.
IND	Indulgence × Restraint	Relates to the degree of freedom that a society gives to social norms and how it influences individual aspirations. High degree of indulgence means that a society allows free gratifications of basic human needs and desires; while low IND degree means a society that controls and restrains these gratifications, regulating through social norms.

that may lead to demotivation and undesired behaviours [51]. Many of these variables are not so easy to represent in educational systems, since they deal with abstract knowledge (e.g., culture) which needs to be systematically defined for virtual environments. These variables that permeate the users environment could potentially influence the outcomes achieved by gamification [34]. To overcome such issues, recent work proposed adaptive gamification, which aims to achieve the desired engagement and learning outcomes by adjusting the game-like elements to better suit users' needs and characteristics [35]. Furthermore, adaptation in gamification has been explored through different lenses and approaches, from demographics to gaming profiles [35], using different sets and groups of gaming elements. Nonetheless, these game elements are not so easy to define, and contain different terminologies and concepts in the literature [43]. Furthermore, since context is an important factor for gamification success, it is essential to choose a set of elements that is aligned with the field being explored.

Considering gamification elements for the field of education, the recent work of Toda et al. [48] proposed the Taxonomy of Gamification Elements for Educational Environments (referred as TGEEE; concepts in Table 2). This taxonomy encompasses a dictionary containing 21 gamification elements, their respective synonyms and which dimensions they are referred to. According to the authors, this taxonomy can be used to design and analyse gamified educational systems. It is divided into five dimensions that are linked to specific interactions in educational environments [50]. Besides, authors also claim that these elements were based on literature reviews in the field of education, encompassing many of the elements found in this educational context, and were validated by experts in education.

As can be seen in Table 2, each of the 21 elements were considered useful in educational environments and encompass a set of elements that can be found in the gamification literature. However, few studies in the field of gamification deal with or are concerned with cultural aspects of the user (or student). Whilst context is considered both useful and elusive [26, 35], culture, as part of the context, is potentially easier to detect, and arguably not variable. AlMarshedi et al. [2] created a conceptual framework that explains how social and cultural elements impact behaviour. The authors noted that a way to advance the field is by exploring the users' interaction influences and cultural values. A recent literature review conducted by Klock et al. [26] found only two studies where gamification was used alongside culture (Hofstede's model). In this study [36], the authors explored how Individualism and Collectivism influence the persuasive strategies, finding significant differences between the users' persuasive profiles; e.g., collectivists leaned more towards social interactions.

2.3 Related Research

For related works, it is essential to understand past works that have similar goals to ours, attempting to understand how *culture* can contribute to adapt *gamification in education*. According to theoretical works [2, 24, 52], culture is essential but often neglected in gamification studies, especially in education. However, literature still lacks to find empirical evidence or models to link these concepts [26]. To find and map empirical works, we conducted a systematic

Table 2: TGEEE proposed in Toda et al. [48]

Element	Description	Dimension
Acknowledgement	A feedback that praises the students' specific actions; can be used to define desired behaviours; e.g., increase the number of interactions in a learning system. Some examples and synonyms are badges, medals, trophies.	Performance
Chance	Random events that increase or decrease the odds of certain actions or outcomes. Some examples and synonyms are randomnesses, luck, fortune.	Ecological
Competition	When students compete against each other towards a goal. Some examples and synonyms are Player vs. Player, scoreboards, conflict.	Social
Cooperation	When students collaborate to achieve a goal. Some examples and synonyms are teamwork, co-op missions.	Social
Economy	Transactions within the game, monetising game values and other elements. Some examples and synonyms are markets, transaction, exchange.	Ecological
Imposed Choice	Decisions that the student is obliged to make in to advance in the system. Some examples and synonyms are judgements, forced choices.	Ecological
Level	Hierarchical layers presented in the system, which provide a gradual way for the student to obtain new advantages as they advance. Some examples and synonyms are character levels, skill level.	Performance
Narrative	Order of events where they happen in the system. These are choices influenced by the students' actions. An example would be a karma system, where the students' actions subtly influence the system. *(not to be confused with Imposed Choice).*	Fiction
Novelty	New, updated information presented to the student continuously. Some examples and synonyms are changes, surprises, updates.	Personal
Objectives	Guide the students' in the system. Quantifiable or spatial, from short to long term. Some examples and synonyms are missions, quests, milestones.	Personal
Point	Unit used to measure students' performance or actions. Some examples and synonyms are scores, number of kills, experience points.	Performance
Progression	A way for students to track their position within the content in the system. Some examples and synonyms are progress bars, maps, steps.	Performance
Puzzles	Cognitive challenges within the system that should make a student think. Some examples and synonyms are actual puzzles, cognitive tasks, mysteries.	Personal
Rarity	Rare resources and collectables. Some examples and synonyms are limited items, rarity, collection.	Ecological
Renovation	The capability of a student to redo/restart an action. Some examples and synonyms are extra life, boosts, renewal.	Personal
Reputation	Titles that the students can accumulates within the game. Some examples and synonyms are titles, status, classification.	Social
Sensation	Use of students' senses to create new experiences. Some examples and synonyms are visual stimulation, sound stimulation.	Personal
Social Pressure	Pressure exerted through social interactions with another student(s) in the system. Some examples and synonyms are peer pressure, guilds.	Social
Stats	Visible information used by the student, related to their outcomes within the system. Some examples and synonyms are results, health bar, indicators, data from the game presented to the user.	Personal
Storytelling	Fictional context that can be used in the system. Some examples and synonyms are stories told through animated scenes, audio queues or text queues.	Fiction
Time Pressure	Pressure through time. Some examples and synonyms are countdowns, clock, timer.	Ecological

mapping, using the protocol proposed by Petersen, Vakkalanka and Kuzniarz [38] and Kitchenham et al. [25].

Based on the protocol, we focused on identifying works that relate culture and gamification to the education field, that were published in the past few years. As the term 'gamification' was only relatively recently coined[1], we limited our search for the period 2009-2020. Initially, we defined our search question in a broad sense: *How gamification, culture and education are related in the literature?*. Thus, we searched for works based on the following research string:

> *gamification* **AND** (*cultural* **OR** *culture*) **AND** *education*.

Next, we selected the following databases, based on previous systematic studies on computer science and education fields: ACM Digital Library, ScienceDirect, IEEE Xplore, Scopus, and Taylor and

[1]The term 'gamification' was coined in 2003 by Nick Pelling, a British-born computer programmer and inventor. However, it only hit the mainstream due to Foursquare in 2009.

Francis. In those databases, we chose to search not only within titles, but also abstracts and keywords, to return as many as possible potentially relevant papers. In addition, we defined as our inclusion (i.e., filtering) criteria: (i) papers in the English language; (ii) papers that relate culture with gamification in educational scenarios; (iii) papers that present empirical evidence; (iv) full papers. Any paper that did not match our inclusion criteria would be automatically discarded. Since we adopted the gamification definition presented in Deterding et al. [6], we did not consider papers that dealt with serious games or digital games. These criteria were based on previous systematic mappings [26, 51].

After running our search string, the total number of papers found[2], which represented all three themes (education, gamification and culture) as well as obeyed all filtering criteria, across all four databases, over the considered time period, was quite low (N = 121). Scopus was the one with most papers (N = 105), followed by ScienceDirect (N = 9), and IEEE Xplore (N = 7). We did not find any study on ACM Digital Library, and Taylor and Francis. After further manual screening the papers, we found 2 potential candidates from Scopus, 1 from IEEE Xplore and 1 from ScienceDirect (Total = 4). However, after reading the remaining full papers in their entirety, *none of these studies addressed how culture influences gamified educational applications.*

Table 3: Results from the systematic mapping

Database	Papers found	Candidate papers	Papers selected for analysis
Scopus	105	2	0
ScienceDirect	9	1	0
IEEE Xplore	7	1	0
ACM Digital Library	0	0	0
Taylor and Francis	0	0	0
Total	121	4	0

Table 3 summarises the results from our systematic mapping. We did not find any work that relates culture and gamification in the education field, this might occur due to culture and gamification being a recent field of study, this is evident in the literature review conducted by Klock et al. [26] where the authors found only two papers dealing with culture, in the field of health. Most of the works that were found in our study dealt with culture related to how to use gamification to teach a different language, rather than exploring cultural aspects and factors in the system gamification design.

Thus, the literature review showcased the clear need of a model to offer new ways to adapt gamification, based on cultural factors, as proposed by us in this paper.

3 METHODS AND TOOLS

Due to the abstraction of concepts dealt in this work, we opted to follow a qualitative approach, to design our conceptual model. We opted for a conceptual model since it can optimise and save time in the development process, followed by a survey method and quantitative data to evaluate it. The qualitative approach was chosen due to its method of turning unstructured data into information for the context dealt with [5]. According to [5], qualitative research follows three steps: (i) problem definition and data collection; (ii) analysis; and (iii) making inferences about the studied object.

3.1 Problem definition and data collection

In the first step, we defined the scope of this study as: to create a model of relations between cultural aspects and gamification elements, to be used within educational environments. We explored theoretical research on the fields of gamification and culture, searching for models and data within this subject.

We opted to use Hofstede's dimensions [21] due to being the most widely used model for adaptation, as well as being used within other studies in the field of education [12, 13, 15, 37, 45, 47]. Recent studies also present results on the impact of using Hofstede's model with students' achievement and assessment [13]. A brief relation between this model and games was made but not further explored nor focusing on educational aspects, which allow us to infer some relations within gamification elements [31]. As for the gamification elements, we selected the Taxonomy of Gamification Elements for Educational Environments (TGEEE) [49], since it is the most recent work which summarises gamification elements that are used in educational applications, as well as defining layers that allow us to analyse the gamification within learning systems. Besides, it was evaluated by experts in the field of gamification and education [50].

3.2 Analysis

In the second step, we analysed the data that was found and collected. Initially, we used an *ontological approach* to aid in this phase, consisting of three steps: (i) a conceptual mapping; (ii) semantic mapping; (iii) and ontology definition, based on Ontology 101 [33]. We opted for the ontological engineering approach since ontologies are used to create models about the relation of things [22]. Ontology 101 approach is used to generate ontologies that can be used to extrapolate concepts and relations. Since we did not find any work in the literature to address the concepts presented in this study, we opted to design a generic ontology, which is used to infer a concept to other domains and could be further improved by other studies [16, 22]. In this work, we generalised the relations between cultural dimensions and gamification elements, to be used in educational environments.

Concept maps are used to identify the relations between concepts, and it is used in ontology engineering to visualise the main concepts and their definitions [32]. We used the conceptual mapping to find the Concepts of our model. These maps are also suggested during ontological engineering processes [8, 10, 23, 46]. Semantic mapping is a method used to organise and structure abstract concepts, to visualise possible similar meanings [23]. It is also used in ontology engineering to find concepts and attributes, as well as to support in the transition of existing ontologies to new ones. In this work, we used Semantic mapping to identify possible attributes of the ontology. Finally, the ontology definition happens when we infer the concepts, attributes and relations of the findings in the previous mappings, making abstract concepts into tangible concepts that can be understood and used by computational tools and/or experts in the field [22, 33]. To verify the integrity of our model, we analysed and compared it with another model presented

[2]Complete list of papers presented in https://bit.ly/33jWFm0

in the literature [19] that addresses Hofstede's culture model in general, using a semantic mapping to identify similar concepts between their model and ours. The summary of the second step of our qualitative approach can be seen in Figure 1. We opted for the model proposed by Heimburger [19] since it was the first one to propose the Hofstede's model into a generic ontology.

Figure 1 presents a flowchart of our methods. Initially, we began the conceptual mapping, by identifying relations between concepts, e.g. in Figure 1, *Game is-a Software*. Following, the semantic mapping is used to identify possible attributes of a given concept, e.g. possible Video-game genres are Role-Playing Games (RPG) and Action Games. Finally, the model definition is used to link the concepts and attributes and its possible sub-attributes, e.g. a Game has a Game genre, which is an RPG. In the context of our work, we can say that *Cooperation is-a Gamification element*, or *Collectivism is-a Cultural dimension*.

3.3 Inference

In the third step, we used the knowledge obtained from the previous steps and defined our initial relations between the concepts. In this step, we relate concept and attributes, define the relationship between the dimensions and gamification elements. In other words, we define which elements are suitable to be associated with the given dimension. In this example, *Cooperation and Gamification Element* are concepts, while *is-a* is the relation between them, meaning that one is part of another. After identifying these relations between the elements in Hofstede and TGEEE, we began the semantic mapping step. This step is responsible for structuring the concepts' definitions and analyse how they can relate with other concepts, e.g.: in Hofstede's model, the concept of *Individualism* and *Collectivism* are related with *social interactions* (attribute) where this dimension influences the way people interact within a group; In the TGEEE, *Cooperation* is-an element from the *social dimension* (another concept) that describes collaborative *social interactions* (attribute) towards a goal. After defining the concepts and definitions, we began to design the model relating the concepts between Hofstede's model and TGEEE elements, e.g., Knowing that *Collectivism* has an attribute *social interactions*, and *Cooperation* also has an attribute *social interactions*, we can infer through our model that *Collectivism* can be associated to *Cooperation*. Through this systematisation, we managed to achieve an initial version of our model (Figure 2).

3.4 Evaluation design

To evaluate this model, we opted to conduct a survey, due to its low-cost and reliability [30], followed by analysing the data collected in this survey using descriptive statistics. Using the guidelines proposed in [30], we divided the survey design into three steps: (i) population definition; (ii) question design; and (iii) analysis. For the first step, we defined our population to be experts in gamification, culture or education. To be considered an expert, in this work, we considered people with experience or publications within these three fields. To recruit these participants, we conducted a literature review on the themes of cultural studies or gamification (both applied to education). This literature review consisted of finding venues where we could find experts in two or all the three fields (e.g., the proceedings of the Cultural Aware Tutoring Systems - CATS - conference). Next, we invited those experts through email (convenience sampling). The experts were presented with the model resulting from the qualitative analysis (Figure 2) and each of Hofstede's and TGEEE for consulting during the survey[3].

For the second step, we aimed at identifying instruments that could be used/adapted to evaluate models within our context. Since the study presented in the TGEEE model [49] contained an evaluation that has overall good reliability ($\alpha > 0.7$) we opted to adapt to our context (convenience), measuring the relations between the elements of the model based on descriptions, coverability, and concordance. These items were aligned with what we aimed in this model as well, by evaluating the relations between the concepts and their descriptions to design it. The questions consisted of a sentence formed by "Do you agree with..." followed by the construct we intended to measure. These questions were measured through a Likert scale, from 1 to 5, where 1 being "Totally Disagree", and 5 being "Totally Agree". Additionally, we included open-end questions so the experts could provide insights on how to improve the model, which relations they did not agree and which relations they could include. We also included demographic data from the experts (gender, age, country, field expertise, years working in the field, and if they had worked with education before). For the third step, we used descriptive statistics to analyse and report the data. The complete survey can be found in: https://forms.gle/nnrKmEvRit9BMH5p6.

It is worth to mention that the question design was supervised by experts in both fields, gamification AND culture. Gamification experts (N = 8) had more than 5 years of experience working in the field, culture experts (N = 2) also had a background in the field of HCI, and more than 5 years of experience in the field.

4 RESULTS AND DISCUSSIONS

This section presents our results. Initially, we present the validation of our model, following by the description and final model (Figure 3). In addition, we present the limitations of our work.

4.1 Evaluation

Initially, we contacted 68 researchers from the fields of gamification or culture, however only 8 answered our survey. Our experts are 6 female and 2 male, ranging from 31 to more than 45 years old from five different countries: United States (2), United Kingdom (1), Philippines (1), Japan (1) and Brazil (3). Regarding the fields of expertise, most of our experts came from the field of gamification (6), followed by HCI (2), Computers in education (2), Artificial Intelligence (1), and Software engineering (1), with a minimum of 5 years of experience and maximum of 25. All of the experts worked in the field of education.

Concerning the model evaluation, when asked if the elements are related (concordance) with the dimensional cultures, most of the experts (N = 5) had a positive agreement (above 3 in the Likert scale), meaning that they agreed positively with the way the relations were made, associating the cultural dimensions and gamification elements. Regarding the descriptions presented to make the relation, our model also achieved a positive agreement within half of the

[3]The descriptions presented to the participants can be found in the following link: https://bit.ly/3bInzYw

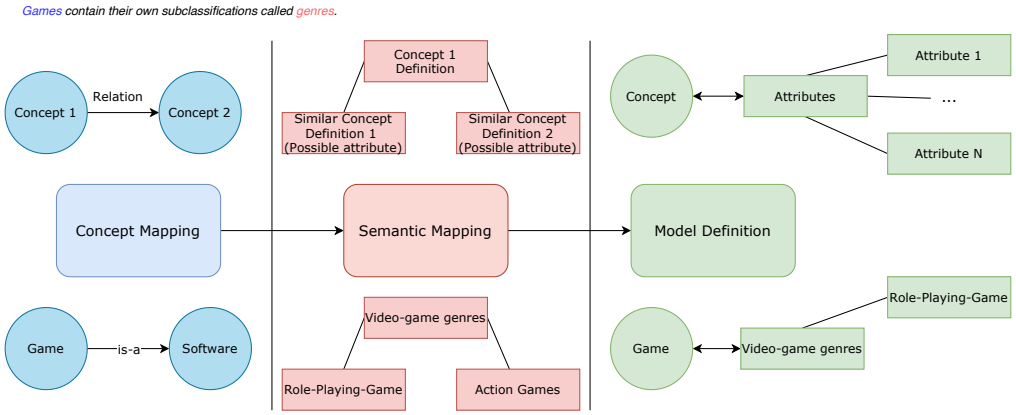

Figure 1: Method flowchart

Hofstede's Dimension	Gamification element
Power Distance	**Rarity, Economy, Reputation**
Power Distance is related to the acceptance on the presence of hierarchical institutions, which can be represented through the game elements **Rarity**, **Economy**, and **Reputation**	
Individualism x Collectivism	**Cooperation, Competition, Social Pressure and Reputation**
Individualism and Collectivism are related to the ties between individuals when they are loose or strong. This dimension can be represented in the following gamification elements **Cooperation**, **Competition**, **Social Pressure** and **Reputation**	
Uncertainty Avoidance	**Point, Level, Stats, Acknowledgement, Progression, Chance**
Uncertainty Avoidance is the extent on how individuals are comfortable in changing the way they live or feel threatened by uncertain and unknown situations. This dimension can be seen through elements that capture the performance of users as **Point**, **Level**, **Stats**, **Acknowledgement**, **Progression** and **Change**	
Masculinity x Femininity	–
Masculinity is related to cultures in which gender roles are clearly distinct while Femininity describes cultures where gender roles overlap. We did not find any elements to represent this dimension.	
Long-Term Orientation x Short-Term Orientation	**Time Pressure**
Long and Short-term orientation are related to planning for future in advance and/or present oriented actions. The element related to this dimension is **Time Pressure**.	
Indulgence x Restraining	**Imposed Choice, Objective, Sensation, Puzzle, Renovation, Novelty**
Indulgence x Restraining are related to the regulation through social norms or allowance of basic drives related to fun. The elements related to this dimension are **Imposed Choice**, **Objective**, **Sensation**, **Puzzle**, **Renovation** and **Novelty**.	

Figure 2: Result of the qualitative approach that was presented to the experts

experts (N = 4), with one expert stating that some elements were missing in the descriptions (e.g. no elements presented in MAS dimension). Finally, when asked if the elements are well-aligned with all the dimensions, we had half of the experts (N = 4) towards a disagreement, with three experts towards an agreement. In this variable, we noticed a discrepancy between the opinions when analysing the comments of the experts, and we tried to deal with all the disagreements to propose the model seen in Figure 3.

We also asked which of the dimensions relations they disagreed with. According to their responses, IND and LTO were the relations they disagree the most (N = 3 experts), followed by UAI and MAS (N = 2 experts), and PDI (N = 1 expert). Based on their comments, we removed some of the elements (e.g., Novelty, Renovation and Puzzle from IND) and added new ones (e.g., Narrative, Objective and Progression to LTO). All of the experts agreed with the relationship formed between IDV and social gamification elements, so no changes were made in these dimensions. No details were given on the disagreement on the PDI dimension so that this dimension did not change.

In addition, we asked which elements the experts did not convince them within the relations. According to one expert, the taxonomy might have missed some elements (e.g., customisation) that could be associated with genders, while other expert stated that "Time Pressure" might not be a good element to represent LTO, but Long-term and Short-term "Objectives" would be more appropriate alongside "Progression". Finally, one final expert stated they disagreed with the following elements Competition, Cooperation, Narrative, Novelty, Objectives, Puzzles, Renovation, Social Pressure, Storytelling, but did not provide enough details on this choice. Some other suggestions were made to improve the model as: including Narrative in LTO; including Competition, Cooperation, Social Pressure, and Storytelling as a way to measure the MAS index; Remove Puzzles, Novelty and Renovation from IND.

Considering the overall acceptance of the model, We had mixed views where 1 expert totally disagreed, 3 experts were towards a disagreement, 2 experts were towards an agreement, and 2 experts totally agreed with. In other words, half of the experts were in the disagreement spectrum and half in the agreement spectrum, with more experts totally agreeing with the model as it is (N = 2) than disagreeing (N = 1). In other words, experts identified and suggested modifications on the model, to be presented and used. Overall, based on all responses, we can observe that our model received positive feedback and acceptance. Even though we could not map Storytelling and Narrative elements properly, experts suggested that they could be aligned with LTO (Narrative) and MAS (Storytelling) indexes, which is worth to consider in future interactions. According to the acceptance of the relations, IDV did not receive any criticism which aligns with previous studies that are concerned with culture and social elements in gamification [2].

4.2 Model

After evaluating the model reached in our qualitative approach, we achieved the model presented in Figure 3. In this model, we relate each dimension presented in Hofstede's culture model to a gamification element presented in TGEEE.

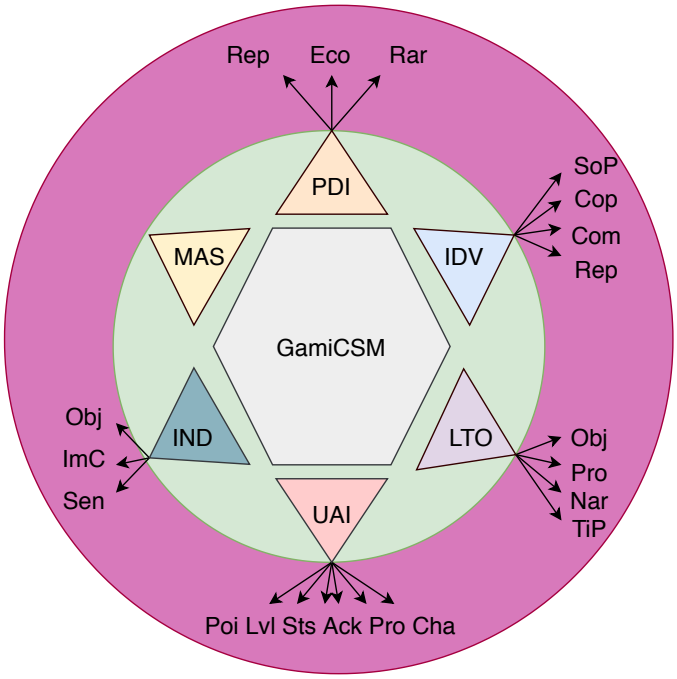

Figure 3: GamiCSM. In green: Cultural dimensions. In pink: gamification elements

As we can observe in Figure 2, Power Distance (PDI) was related to elements concerned with the notion of power, in this case, Rarity (Rar) deals with rare resources and Economy (Eco) is tied to the market and transactions within a system, both are ecological elements that deals with the environment they are implemented in and provide a sense of power to the user. When tied with Reputation (Rep), which represents social hierarchies, they can be used in systems where the Power Distance Index is high and should be avoided where this index is low.

Following, IDV dimension was related to social gamification elements, since both are concerned with social interactions. Cooperation (Cop) and Social Pressure (SoP) should be related with Collectivism (low IND), since in Collectivist societies people tend to be more empathetic and think in the group as a whole, Cooperation features in educational systems might be appealing, while Social Pressure might engage people to collaborate. Concerned with Individualistic societies, where individuals prioritise their needs over others, Reputation (Rep) and Competition (Com) might work better, since these individuals do not consider the needs of the group as a priority.

Concerned with UAI, this dimension is related to change in individuals' actions or feel threatened to embrace unknown situations. We though Performance elements (Point - Poi, Level - Lvl, Stats - Sts, Acknowledgement - Ack, and Progression - Pro) might be suitable for groups that are not comfortable with changes, where they can track and measure every action (low UAI). When adding the Chance element (Cha), this adds a random and uncertainty to the events of a system, which might be suitable for people that prefer changes (high UAI).

We did not match any elements with MAS dimension due to its abstraction, which might be covered in the future, more details in the Limitations section. Considering the short-term and long-term orientation (LTO), as this dimension is related to planning actions or the direct response to present situations, the elements that are best suited to deal with it are Objectives (Obj), alongside Progression (Pro), Narrative (Nar), and Time Pressure (TiP), as it enforces the necessity to plot a strategy in a determined amount of time. However, Time Pressure might not be suited to users accustomed to long term strategies and reasoning.

Finally, indulgent cultures (IND) place more importance on the freedom of speech and personal control, while these same characteristics might be considered inappropriate and unnatural in restrained cultures. As such, the elements of Imposed Choice (ImC), and Objective (Obj) might be better used on restrained cultures, and Sensation (Sen) tend to be better used on indulgent cultures. This dimension can also be tied to the Power Distance dimension, as usually, cultures with high Power Distance index are usually more restrained and vice versa.

4.3 Limitations

Here, it is important, firstly, to note some limitations of the systematic mapping used in our literature review: (i) whilst we conduct the search based on more than just titles, we did not do any search in the full body of the paper; this decision was made due to considering that, if the paper was focused on the areas of interest, these should, normally, have appeared in the triad title, keywords, abstract; (ii) we did not analyse the papers concerned with teaching languages; this we considered to be beyond the scope of this work; (iii) we also did not consider papers on serious games; this was due to the fact that we adopted the concept of 'gamification' as seen in the work of Deterding et al. [6]; (iv) we only considered papers in English language, which might infer a bias to our analysis since cultural studies can be found in other languages. We believe this can be further explored in future studies.

Furthermore, some limitations of our evaluation work are worth to be mentioned. First, we did not apply a pilot study to verify the integrity of our instrument. However, there were HCI experts involved in the development and the survey received feedback from two experts on the field of HCI that had previous experience (more than 5 years), and also worked previously with surveys. Another limitation was that we did not manage to get answers from any expert from the field of culture in our evaluation, which might limit our analysis to the fields of gamification and education. The experts that participated in the development of the survey could not participate in the evaluation due to conflict of interests. The number of experts that evaluated this model was relatively low. Although we have contacted 68 experts, we only obtained 8 responses, which may limit somewhat the generalisation power of our work. However, as they all are experts in education, and as most

expert-based evaluations are less concerned with the numbers, and instead are interested in the in-depth focus of their feedback, our findings may be considered promising.

Finally, considering our model, we find the concepts of MAS too abstract to be aligned with the gamification elements of TGEEE. Although some experts did provide some suggestions, we found that these elements were still too simple to represent the concepts in these dimensions. This was also agreed by the experts of culture and HCI that supervised the conception and design of the model.

5 CONCLUSIONS AND FUTURE WORK

In this work, we proposed to explore the research gap on how to relate gamification and culture. We conducted a mixed approach study, aiming at creating a model to relate cultural dimensions and gamification elements for educational environments. Through our evaluation, it is perceived that we received mixed comments on the model on its current state, although some improvements can be made in future versions to improve it. Our main contribution is the first model to relate these two worlds that can potentially help gamification designers and educators to understand how culture can affect and is related to gamification outcomes in education. This may allow different kinds of adaptation strategies tied not only to students' demographics and behavioural profiles but also their countries. We also contribute by providing a protocol for systematic studies that can be replicated to include other terms to explore gamification, education and culture. Thus, through the execution of this study we can identify topics that could be worth exploring in future research:

- Validate the model through data-driven studies: by analysing the preferences of gamification elements and matching them with the dimension they are associated with, e.g. in countries with a high PDI, people might prefer elements as Reputation and Economy;
- Expand the selection of gamification elements to other fields;
- Provide empirical evidence through experiments on cross-cultural studies, to verify the integrity of the model to different cultures.

It is worth to emphasise that this model is part of a greater project that aims to explore ways to personalise gamification through different constructs. Culture is included within those constructs and must be tied to other aspects as contexts, demographics (e.g., gender and age), and behavioural profiles, aiming to promote the best immersive learning experience for students. Through this model, we believe we can provide some initial contribution to the field of gamification, culture, and education. The results contained in this study can be used to support the decision-making process of designers and educators to develop educational systems based on culture, and the model can also be used to explore and analyse how different cultures influence gamification elements and how it can influence students on these cultures as well (e.g., verify if their preferences match their cultural indexes based on Hofstede's original scores).

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